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ET-540(B)

B.Tech. Civil (Construction Management)

Term-End Examination

December, 2013

ET-540(B) : FLOW IN OPEN CHANNEL

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any five** questions. Give neat sketches wherever necessary. Use of non programmable scientific calculator is **permitted**.*

1. (a) What are the main objectives of the computation methods of water surface profiles in an open channel flow ? Briefly discuss the most appropriate method for both prismatic and non prismatic channels of any shape. **2+5=7**

   (b) A trapezoidal channel has a bed width of 10 m, bed slope 0.0015, side slope $z = 1.5$. It carries a discharge of 10 m^3/s and the Mannings Roughness 'n' is 0.08. A dam is to be constructed upon the channel so as to back up the water to a depth of 1.5 m immediately behind. Assuming the energy coefficient equal to 1.0 and the upstream end of the profile at a depth equal to 1% greater than normal depth compute the back water profile created by the dam. **7**

2. (a) What is Hydraulic Jump phenomenon ? What are the essential conditions for a Hydraulic Jump to occur in a Horizontal rectangular channel ? Express the same interms of relationship between initial and sequent depths. 2+5=7

(b) A rectangular channel has a width of 7 m on a bed slope of 0.005. The water flows with a depth equal 0.65 m at vena contracts when the discharge from a sluice gate is regulated at 100 m^3/s. The Mannings roughness factor 'n' being 0.025 ; compute the flow profile. 7

3. (a) Prove the following equation for G.V.F. Assume the necessary data clearly mention the assumptions made. 7

$$\frac{dy}{dx} = S_o \frac{\left[1 - \left(\frac{y_n}{y}\right)^{10/3}\right]}{\left[1 - \left(\frac{y_c}{y}\right)^3\right]}$$

Where, terms have their standard meanings.

(b) Discuss the flow profiles with a neat and proper labelled sketch for following conditions : 3.5+3.5=7

(i) Profile in a Horizontal Channel

(ii) Profile in an Adverse Channel

4. (a) A hydraulic jump occurs in a rectangular channel section. The depths of flows after and before the jump are 0.3 and 0.7 m respectively. Calculate the critical depth and the loss of water power per unit width of the channel section for a discharge $q = 6.99$ m^3/s. 2+5=7

(b) In a trapezoidal channel section having a bottom width of 5 m, longitudinal slope as 0.0015 discharge 10 m^3/s ; n = 0.15 and side slope 1.5 : 1 ; find the normal depth of flow ? If the normal depth of flow has to be kept 1.0 m what changes would you suggest in the longitudinal normal slope S_n ? 7

5. (a) Draw the specific energy curve and properly lable the same. Prove the criteria for minimum specific energy is : 3.5+3.5=7

$$F = \frac{V}{\sqrt{\left[g\frac{D\cos\theta}{\alpha}\right]}}$$

(b) Draw the definition sketch of a Hydraulic jump in submerged flow conditions. Also, show that : 3.5+3.5=7

$$\phi = \frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8Fr_1^2}\right) - 1$$

Terms have commonly used meanings.

6. (a) Draw a dimensionless curve for determining the normal depth of flow with known section factors. Discuss the effect of changing side slope for a trapezoidal section. 3.5+3.5=7

(b) A parabolic trench has the top width of 15 m. Find out the section factor, hydraulic depth (D) and hydraulic radius (R) corresponding to a flow depth of 5 m for uniform flow conditions. 3.5+3.5=7

7. Write short notes on **any four** from the following : **4x3.5=14**

(a) Standard step method

(b) Specific energy

(c) Hydraulic drop

(d) Reynolds Number

(e) Ganguillet - Kutter's Equation

(f) Uniform Flow